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PART--I-- Orders and Notifications by the Government of Tripura, The High Court, Government Treasury etc.

GOVERNMENT OF TRIPURA
HOME DEPARTMENT

NO.F.47(1)-PD/2006(Part-I)/3088 Dated, Agartala, the 21st October, 2021.

NOTIFICATION

In exercise of the power conferred by proviso to article 309 of the Constitution of India, the Governor of Tripura in consultation with the Tripura Public Service Commission is hereby pleased to make the following Rules regulating the method of recruitment to the post of **Senior Scientific Officer,** (Physical/Chemical/Biological Discipline), Group-A, Gazetted of Tripura State Forensic Science Laboratory under Home Department, namely:-

1. **Short title & commencement**:-

(a) These rules may be called "Recruitment Rules, 2021" for the post of Senior Scientific Officer, (Physical/Chemical/Biological Discipline), Group-A, Gazetted of Tripura State Forensic Science Laboratory under the Home Department.

(b) They shall come into force with effect from the date of its publication in the Tripura Gazette.

2. The name of the post(s) shall be as specified in Column-1 of the Schedule annexed hereto.

3. **Number, Classification and scale of pay**:

The number of the said post, its classification and the scale of pay attached thereto shall be as specified in Column-2 to 4 of the Schedule annexed hereto.

4. **Method of recruitment, age limit, qualification etc**:- The method of recruitment to the said post, age limits, qualifications and other matters relating to the said post shall be as specified in Column-5 to 13 of the said schedule.

5. **Disqualification** No person-

(a) who has entered into or contracted a marriage with a person having spouse living;

(b) Who, having a spouse living, has entered into or contracted a marriage with any person, shall be eligible for appointment to the said post:-

Provided that the State Government may, if satisfied that such marriage is permissible under the personal law applicable to such person and the other party to the marriage and that there are other grounds for so doing, exempt any person from the operation of these Rules.

6. **Power to relax**:- Where the State Government is of the opinion that it is necessary or expedient to do so, it may, by order, for reasons to be recorded in writing and in consultation with the Tripura Public Service Commission, may relax any of the provisions of these Rules with respect to any class or category of persons.

7. **Saving**:- Nothing in these Rules shall effect reservations, relaxation of age limit and other concessions required to be provided for the Scheduled Castes, the Scheduled Tribes, Ex-servicemen and other special categories of persons in accordance with the orders issued by the State Government from time to time in this regard.

8. **Interpretation**:- If any question arises relating to the interpretation of these Rules, it shall be referred to Home Department, Government of Tripura, whose decision thereon shall be final.

By order and in the name of the Governor,

21.10.2021

(A. Deb)
Deputy Secretary to the
Government of Tripura

Recruitment Rules for the post of Senior Scientific Officer (Physical/ Chemical/ Biological discipline), Tripura State Forensic Science Laboratory under Home Department, Government of Tripura

SCHEDULE

1.	Name of the post(s):	Senior Scientific Officer (Physical/ Chemical/ Biological discipline), Tripura State Forensic Science Laboratory.
2.	Number of post (s):	4 (four) plus additional posts as and when created. (i) Physical Discipline – 01. (ii) Chemical Discipline – 02. (iii)Biological Discipline – 01.
3.	Classification:	Group-A (Gazetted).
4.	Scale of pay:	Level-14 of Tripura State Pay Matrix-2017 (Pre-revised PB-4, Rs.15,600-39,100/-, Grade Pay Rs.5400/-) subject to revision by the State Government from time to time.
5.	Method of recruitments whether: by direct recruits or by deputation / transfer and percentage of the vacancies to be filled by various methods:	**75% post will be filled up through promotion and 25% posts through direct recruitment.** In case of direct recruitment by TPSC, selection is to be made on the basis of written examination followed by interview in which the marks distribution for written test and interview have been made as per the New Recruitment Policy for Group-A posts under administrative control of Govt. of Tripura notified vide letter No.F.20(1)-GA(P&T)/18 dated 05/06/2018. Scheme of examination for recruitment along with the syllabus and marks distribution for written examination & interview are enclosed in **Annexure A, B & C** for Physical, Chemical & Biological discipline respectively.
6.	Age limit for direct recruitment:	Age not less than 18 years and not more than 40 years. Relaxable by 5(five) years in case of ST/SC/PH and Government servants.
7.	(A) Educational and other Qualification required for direct recruitment: i) For Physical Discipline (Physics/Ballistics Division) : (ii) For Chemical Discipline (Chemistry/Toxicology/ Document Division): (iii) For Biological discipline (Biology/Serology Division, DNA Division) :	(A) Discipline may be arranged as follows:- (i) M.Sc. with 50% marks in Forensic Science (with Physics/Mathematics as one of the subjects) or in Physics/Mathematics from a recognized university. (ii) M.Sc. with 50% marks in Forensic Science (with Chemistry as one of the subjects) or in Chemistry/Biochemistry from a recognized university. (iii) M.Sc. with 50% marks in Forensic Science/ Botany/Zoology/Microbiology/Biotechnology/Physical Anthropology or Genetics (with Botany/Zoology as one of the subjects) or MD Degree in Medicine or equivalent from a recognized university.

	(B) Experience: (C) Desirable Qualification:	(B) Having 3(three) years experience in research, training and analytical work in the relevant field. (C) Knowledge of Bengali or Kokborok.
8.	Whether age and Educational qualification prescribed for the direct recruitment will apply in case of promotees:	Age:- No Educational qualification:- Yes.
9.	Whether Selection post or Non-selection post:	Selection
10.	Period of probation, if any:	2(two) years.
11.	In case of recruitment by promotion/deputation/transfer/ Grade from this promotion/ transfer/deputation is to be made.	Promotion from Scientific Officer of Tripura State Forensic Science Laboratory who has completed 5 (five) years service in the grade.
12.	If a D.P.C exists, what is its composition:	Group-A, D.P.C.
13.	Circumstances in which TPSC is to be consulted in making recruitment.	As required under **TPSC** (Exemption from consultation) Regulations, 1973.
14.	Repeal	The existing Recruitment Rules for the post of Senior Scientific Officer (Physical/Chemical/Biological discipline) vide Notification No.F.47(1)-PD/2006(Part-I)/2185 dated 26/06/2019, Corrigendum No.F.47(1)-PD/2006(Part-I)/1641 dated 07/06/2021 and all earlier amendments are hereby repealed.

By order and in the name of the Governor

21.10.2021

(A. Deb)
Deputy Secretary to the
Government of Tripura

ANNEXURE -A

SCHEME OF EXAMINATION FOR THE POST OF SENIOR SCIENTIFIC OFFICER (PHYSICAL DISCIPLINE), STATE FORENSIC SCIENCE LABORATORY, TRIPURA

Full marks: 200

(Marks allotted for Interview=20 & Marks allotted for written Test= 180)

Pattern of questions for written Test: Multiple Choice Question (MCQ)

Distribution of marks for written Test:

Sl. No.	Items	Marks allotted
1	English Language	30
2	General knowledge	30
3	Subject matter (Physical Discipline)	120

(1) Syllabus for English Language: Question on English language will cover Synonyms, Antonyms, use of common Phrase & Idioms., use of appropriate Prepositions and Articles, Comprehension, Ordering of words in a sentence , Ordering of sentences, spotting of errors, use of appropriate and qualifying words etc.

(2) Syllabus for General Knowledge: General knowledge with special reference to Tripura and North Eastern States

(3) SYLLABUS FOR SUBJECT MATTER (Physical Discipline):

Unit 1: Conservation Law of momentum, Collisions, impact parameter, centre of mass and lab systems with transformation of physical quantities. Rotating frame of reference, coriolis force, motion of rigid bodies, moment of inertia, angular momentum, torque and precession of top. Central forces, motion under inverse square law, Special Theory of Relativity, Michelson-Morely experiment,Lorentz Transformations-addition of velocities, Time dilation and length contraction, variation of mass with velocity, mass-energy equivalence.

Unit 2: Oscillations, simple harmonic motion, damped harmonic motion, force oscillation and resonance. Wave equation, harmonic solutions, plane and spherical waves, superposition of waves, beats, stationary waves, phase and group velocities.

Conditions of interference, Newton's rings and Michelson's interferometer. Diffraction-Fresnel and Fraunhofer, diffraction by plain transmission grating, Rayleigh criterion, resolving power of grating and telescope Polarisation : Plane, circular and elliptically polarized light, its production and detection .

Unit 3: Kinetic theory of gases, Maxwell-Boltzmann, Bose-Einstein and Fermi- Dirac Distribution. Maxwell's distribution of velocities, equipartition of energy, specific heats of gases, mean free path Brownian motion. Black-Body radiation. Wien's law, Planck' law, Solar constant, specific heat of solids - Einstein and Debye theories.

Unit 4: Electric field and potential, Gauss's law. Poisson's and Laplace equations, dielectrics and polarization, dielectric sphere placed in a uniform electric field. Electromagnetic induction, transformer. Transient behaviour of R-C, and R-L circuits, time constant. Response of an L-C-R circuit for alternating voltages; series and parallel resonance, band-width and Q-factor. Magnetic properties of materials: para, dia ferro, anti-ferro and ferri magnetism. Lasers, He-Ne and Ruby lasers, spatial and temporal coherence, elementary ideas about holography and laser applications.

Unit 5: De Broglie waves. Photo-electric effect, Compton effect, wave-particle duality, Uncertainty principle; size of H-atom, zero point energy, wave packet, finite width of energy levels. Schrodinger wave equation with application ,Hydrogen spectrum, electron spin, Stern-Gerlach experiment, space-quantisation, vector model of atom, J-J and L-S coupling, Zeeman effect, characteristic and continuous x-rays.

Band theory of solids - conductors, insulators and semiconductors; Thermal properties of solids, specific heat, Debye theory, Elements of superconductivity, Meissner effect, Josephson junctions and applications; Elementary ideas about high temperature superconductivity.

Kirchhoff's law, Thevenin, Norton and maximum power-transfer theorems. Input and output impedances. p-n junction diode, use of diode for rectification, zener diode and its use in voltage regulation. Transistor, its biasing, common emitter amplifier. Feedback, Barkhausen criterion, oscillators, Digital electronics-Boolean identities, De Morgan's laws, logic gates and truth tables; Simple logic circuits.

Unit 6: Instrumental Analysis of Glass, Refractive index measurement, methods of analysis of Metals, Alloys, Cement, Sand and elementary knowledge of ore composition and separation .

Forensic methods of soil analysis, Density gradient methods and preparations, Short circuit Analysis, Micro etching processes on metals , restoration of metallic surfaces for vehicle identification numbers, Basic principles of vehicle accident analysis , Tool marks examination, Basic methods of fiber identification and examination. Metal composition and alloys, elementary knowledge of paper making and analysis.

Unit 7: Mechanics:- Velocity and acceleration along radical and transverse direction, tangential and normal acceleration, motion under variable forces, motion in a resistive medium, projectile motion.

Newtonian Mechanics of one and many particle systems, conservation laws, work energy theorem, systems with variable mass, frame of reference, inertial and non inertial frames, Central forces, two body Moment and product of inertia of a body, D'Alembert principle, Motion about a fixed axis, Euler's equation for rigid body motion.

Fluid Mechanics:- General introduction of Fluid dynamics. Kinematics of flow fields, conservation of momentum, irrolational motion, equation of continuity, Bernauli's theorem, viscous fluids, streamline and turbulent flow, Poiseuli's law, Surface tension capillary tube flow, Raynold's number, Stroke's law.

Unit 8: Spectroscopic techniques: Introduction: Properties of light, Interaction of Matter and light, Electro-magnetic radiation & it's application in forensic science; UV/Visible Spectrophotometry and it's application in Forensic Science, Molecular Fluorescence, Infrared (IR) Spectroscopy, & it's Application in Forensic Science, Raman Spectroscopy, Mass Spectrometry, Atomic Absorption Spectroscopy and it's applications in Forensic Science.

Lenses, magnifiers, measuring instruments, Principle and working of Simple - Microscope, Stereo microscope, Zoom stereo microscope, Comparison microscope, light sources- UV, IR, transmitted, oblique light, spotlight.

Principle & working of SEM-EXDA, Raman Spectrophotometer, GC- MS, Neutron Activation Analysis.

Unit 9: Firearms and tool marks: Firearms, Types of Firearms, Firearm Barrels, Anatomy of Ammunition, What happens when ammunition is discharged? Tool marks, various types of tool marks, cartridge cases and bullet comparison, Tool mark comparisons. Collection of fire arms evidence. Distance of firing Determination, shot pattern, Gun powder Residues, Primer Residues.

History and development of firearms, their classification and characteristics, various components of small arms, bore and caliber, relation between bore number of shoguns and internal cross sectional diameter of their barrels, rifling, various class characteristics of rifled bore, purpose of rifling, types of rifling, trigger and firing mechanisms, trigger pull, accidental discharge of firearms, cartridge rifling mechanism, trigger pull, projectile-velocity determination, techniques of dismantling/assembling of various types of firearms, identification of origin-various marks on firearms, factory made/improvised/country made firearms and their constructional features.

Unit 10: Types of ammunition, classification and constructional features of different types of cartridges, types of primers and priming compositions. Propellants and their compositions-black, smokeless and semi- smokeless powders,

Use of brass/copper for manufacture of cartridge cases, different shapes of cartridge cases and their heads-rimmed, rimless, semi rimmed, belted and rebated. Various types of bullets and compositional aspects, Jacketed, non- jacketed bullets, round nose, sharp-pointed, boat-tailed, streamlined, soft point, hollow point and other expanding bullets, various types of wads loaded in shot gun cartridges, shot gun ball ammunition, Identification of origin, head stamp markings on cartridges, improvised ammunition, safety aspects for handling of fire arms and ammunition.

ANNEXURE -B

SCHEME OF EXAMINATION FOR THE POST OF SENIOR SCIENTIFIC OFFICER (CHEMICAL DISCIPLINE), STATE FORENSIC SCIENCE LABORATORY, TRIPURA

Full marks: 200

(Marks allotted for Interview=20 & Marks allotted for written Test= 180)

Pattern of questions for written Test: Multiple Choice Question (MCQ)

Distribution of marks for written Test:

Sl. No.	Items	Marks allotted
1	English Language	30
2	General knowledge	30
3	Subject matter (Chemical Discipline)	120

(1) Syllabus for English Language: Question on English language will cover Synonyms, Antonyms, use of common Phrase & Idioms., use of appropriate Prepositions and Articles, Comprehension, Ordering of words in a sentence , Ordering of sentences, spotting of errors, use of appropriate and qualifying words etc.

(2) Syllabus for General Knowledge: General knowledge with special reference to Tripura and North Eastern States

(3) SYLLABUS FOR SUBJECT MATTER (Chemical Discipline):

Unit 1: Forensic Science-Definitions, History and Development Crime Scene Management and Investigation. Collection, Preservation, Packing and Forwarding of Physical and Trace evidences for analysis.

Unit 2: Analysis and estimation of illicit liquor including methyl, ethyl alcohol, denatured spirit, acetone, chloroform and ether in body fluids, blood and urine.

Analysis of petroleum products and petroleum residues on forensic exhibits. Analysis of oils and fats. Determination of Adulteration in Edible oils, Food Commodities, Fertilizers, Cement and Ornaments.

Pesticide analysis in food products. Analysis of incendiary material from debris. Analysis of Petroleum products for adulteration. Trap cases – Analysis of Dyes used in Trap cases. Analysis of Detergents and Soaps.

Unit 3: Unifying principles, Basic principles, instrumentation and applications of Ultraviolet and visible spectroscopy, Infrared spectroscopy, Atomic Absorption Spectroscopy, Mass Spectrometry, Fluorescence and Phosphorescence spectrophotometry.

Basic principles, instrumentation and applications of pH metry, Potentiometry, Conductometry.

Microscopy-Introduction, Magnification Systems, Lenses, magnifier, Compound Magnifying Systems, Principle and working of Simple -Microscope, Stereo microscope, Comparison microscope, light sources – UV, IR , transmitted, oblique light, spot light.

Unit 4: Chromatography – Chromatographic Techniques : General Principles, paper chromatography, column chromatography, TLC, Adsoption chromatography, partition chromatography, Gas chromatography, Gas-liquid chromatography, Ion exchange chromatography, Exclusion (permeation) chromatography, affinity chromatography, HPLC, HPTLC, Capillary Chromatography.

Electrophoresis : Theory and principles.

Atomic Absorption Spectroscopy, Mass Spectrometry, Raman Spectroscopy. Neutron Activation Analysis and N.M.R., UV-Visible, IR Spectroscopy, Fluorescence, X-rayfluorescence spectrometry (XRF). TEM, SEM and Inductively coupled plasma atomic emission spectroscopy (ICPAES)

Unit 5: Forensic Chemistry : Definition and Scope. Preliminary Screening Methods for some chemical constituents – Spot tests and Crystal tests. Analysis of Toxic Anions – Nitrite, Nitrate Sulphide, Sulphate, Halides and Cyanides. Analysis of CO2, CO and other Poisonous gases.

Analysis of some Metallic poisons – As, Sb, Pb, Ba, Cu, Hg, Zn and Thallium.

Unit 6: Fire and Arson Investigation – Nature and Chemistry of Fire. Types of Arson cases. Detailed Examination of scene of crime. Collection and Preservation of evidences in a arson case. Explosive – Nature, Classification and Composition, Ignition, Combustion and Detonation. Examination of Explosive, Bomb and IED (Improvised Explosive Device). Reconstruction of explosive cases.

Unit 7: Alkaloids-Definition, Classification, Isolation, General Properties and Examination of Morphine, Codeine, Brucine, Strychinine, Nicotine, Atropine, Hyosyamine, Cocaine, Heroin and Barbiturate. Alkaloids from Opium, Cannabis Sativa and Dhatura

Unit 8: Forensic Toxicology: Definition and scope.

Poison – Definition, Classification, Mode of action, Factors modifying mode of action of poison. Methods of poison administration, Toxicological exhibits in poisoning cases, their collection and preservation. Extraction and Isolation of poisons from Visceral Organs and other Biological Specimens. Analysis of corrosive, Irritant and various plant poisons.

Analysis of Psychotropic Drugs- Sedatives, stimulants, opiates, drugs of abuse, Heroin, Methaqualone, Meprabomate, Mescaline, Mandrax, LSD, Amphetamines, Benzodiazepines, Haloperidols and other designer drugs.

Unit 9: Scope & importance of Forensic Document examination; Nature & problems of Forensic Document Examination – Classification of documents; Disputed/ Specimen/ Admitted ; Care, handling, preservation of documents; Observation tests and their application in handwriting examination; Preliminary examination of case documents.

Chemistry of dyes and pigments, Luminescence , Fluorescence, Phosphorescence , types of paper and Inks, techniques used in the analysis of paper & inks, History of Ink, chemical composition of different types of ink, destructive and non- destructive techniques involved in identification of inks: spectral comparison, chemical separation techniques using TLC, HPTLC, GC. Relative and absolute age of ink, techniques involved. Invisible/ secret ink, thermal ink.

Unit 10: Examination of security documents: Currency notes, Passport, Visa, Various identity cards, Stamp papers, travel documents, University/ Board certificates/ mark sheets, their security features, different types of security features and their examination including watermarks, security fiber/threads.

ANNEXURE -C

SCHEME OF EXAMINATION FOR THE POST OF SENIOR SCIENTIFIC OFFICER (BIOLOGICAL DISCIPLINE), STATE FORENSIC SCIENCE LABORATORY, TRIPURA

Full marks: 200

(Marks allotted for Interview=20 & Marks allotted for written Test= 180)

Pattern of questions for written Test: Multiple Choice Question (MCQ)

Distribution of marks for written Test:

Sl. No.	Items	Marks allotted
1	English Language	30
2	General knowledge	30
3	Subject matter (Biological Discipline)	120

(1) Syllabus for English Language: Question on English language will cover Synonyms, Antonyms, use of common Phrase & Idioms., use of appropriate Prepositions and Articles, Comprehension, Ordering of words in a sentence , Ordering of sentences, spotting of errors, use of appropriate and qualifying words etc.

(2) Syllabus for General Knowledge: General knowledge with special reference to Tripura and North Eastern States

(3) SYLLABUS FOR SUBJECT MATTER (Biological Discipline):

Unit 1: Fundamentals of Forensic Science and Scope of Forensic Biology: Definitions, History and Development. Crime Scene Management & Investigation: Basic knowledge, Collection, Lifting, Preservation, Packaging, and Forwarding of different kinds of biological exhibits for analysis.

Legal & Court Procedure pertaining to Expert Testimony, Admissibility of Scientific & Technical evidence- 293 CrPc.

Unit 2: Tools and Techniques: Microscopy- Basic principles and working of simple and compound, comparison, phase-contrast, stereo-zoom, polarizing, Fluorescence, Scanning Electron & transmission electron microscope, Spectrophotometer and U.V. light sources.

Immunology and Immunological techniques: General principles, Precipitin reaction, Gel immune –diffusion, Immuno electrophoresis, Radio Immuno Assay(RIA), Enzyme Link Immuno Sorbent Assay (ELISA), Immune system, Immune -Response, Innate and acquired immunity, antigens,

antibodies, Immunoglobulins, Raising of anti-sera, HLA antigen; Lectins –their forensic significance, Buffers and Biological reagents, Method of sterilization employed for biological work.

Unit 3: Human Anatomy, Physiology: Structural organization and functions of cell including Plasma membrane, intracellular organelles (Nucleus, Mitochondria, Golgi-bodies, Lysosomes, Endoplasmic reticulum, Peroxysomes), Cell division and cell cycle, Chromosomes. Structure and types of DNA and RNA, Transcription, Replication mechanism, Protein Synthesis, karyotyping. Sex Chromosomes/sex chromatin. Abnormal cell growth and tumors.

Introduction to Body Function: External and internal environment, homeostasis. Negative and positive feedback mechanism. Structure and function of the major organ systems: digestive, skeleton, respiratory, endocrine, nervous, excretory, reproductive, cardiovascular and neuromuscular. Structure and function of bio molecules (Protein, Lipid and Carbohydrate), pH, buffer and buffer system; Enzyme, catalysis, enzyme regulation, enzyme inhibition, iso-enzymes.

Physiology of digestive system-Saliva and gastric juices, digestion and absorption. Nervous system–reflex action, reflex-arc and nerve impulse.

Physiology of Respiratory system - exchange of gases, process of pulmonary respiration Respiration.

Physiology of human circulatory system - Heart structure, double circulation, cardiac cycle and its regulation, blood pressure, composition of blood, mechanism of blood clotting, Anti coagulants for blood.

Physiology of human reproductive system; Human male and female reproductive systems, gamete formation, fertilization and implantation.

Unit- 4: Tissues of the body: Epithelia and glands. Classification of epithelia/glands and their functions. Connective tissues. Cartilage- structure and types, Gross structure of bones, formation of bone, fracture and healing.

Unit-5. Skin and its appendages: Structure and functions, pigmentation, blood and nerve supply. Structure of hair, hair cycle- anagen, catagen, telogen. Sebaceous glands, nails, sweat gland. Skeletal muscle, striated and non-striated, muscle.Organization of muscle fibres.Tendons and Nerves.

Unit-6: Body Fluids & their stains: Introduction to various types of body fluids, Composition, Physical pattern and Identification of seminal stains: presumptive tests (U.V. test, Florence test,

Spermine (Barberio) test, Choline test, Acid phosphatase test) and confirmatory test including Azoospermic semen stain (p-30, *Prostate-specific antigen* or PSA, Microscopic examination), Morphological structure of spermatozoa of human and animals, Identification of lochial and menstrual blood stains by microscopic, biochemical and immuno-electrophoretic method, Identification and examination of other body fluids/stains–vaginal, saliva, urine, faeces, vomit etc., Secretor and non –secretor. Identification and examination of body tissues of human/animal. Blood group-ABO, MN, Rh polymorphic blood groups.

Unit 7: Biosystematics & Taxonomy: Chemotaxonomy, Cytotaxonomy, Molecular Taxonomy and General classification of Animals.

Unit-8: Forensic Anthropology: Personal identification techniques as somatoscopy and somatometry. Anatomical description of skeleton of human/animal as relevant to forensic, Ossification & Identification of bones for determination of age, sex, race, stature etc., Forensic Anthropometry/Osteometry and tools involved in it. Determination of personal identity, Sex differences in skull, Pelvis and other bones. Calculation of stature from long bones, Identification of burnt bones, Recovery and identification of skeletal remains in accident, crimes and mass disasters. Recovery, packaging and storage of fleshed and burnt bone remains of human/animal, forensic importance of skeletal pathology and trauma of bones.

Facial reconstructions & Superimposition: Cranio facial superimposition techniques as Photographic & Video superimposition.

Unit-9: Forensic Odontology: Dentition pattern, types, structure and growth of teeth, eruption sequence, age determination, identity of person, role in mass disaster, dental anomalies and their significance in personal identification. Bite marks analysis of human/animal.

10. Hair and Fibres: Morphology and Biochemistry of human/animal hair, determination of origin, race, sex and site. Types and Identification of Fibres: Man-made and Natural fibres and its Forensic significance.

Unit- 11: Forensic Botany: General plant classification schemes. specialisation of forensic botany-morphology, anatomy, systematic, ecology, limnology, Plant architecture- roots, stems, flowers, leaves. Practical plant classification schemes:- vegetables/herbs, fruit bearing trees and plants, trees, shrubs and grasses, plant cell structure and functions. Basic plant tissues.

Unit- 12. Wood anatomy: Various types of woods, timbers, seeds and leaves and their forensic importance. Xylotomy-types of sections, staining and preparation of slides.Identification and matching of various types of wood, seeds and leaves.

Unit-13. Planktonic study: Various types of phytoplankton, diatoms and their forensic importance. Different kinds of diatoms and their morphology, Importance of diatom test in drowning cases, history of diatom test, drowning associated diatoms. Precaution in collection, preservation and forwarding of biological samples for diatom test, methods of isolation of diatoms from different body tissue/ bone marrow and water sample i.e. drowning medium. Preparation and observation of slides.

Unit-14. Forensic Palynology: Study and identification of pollen grains and its forensic importance.

Unit-15. Narcotics, poisonous and alkaloid plants : Morphology and anatomy of plants, types of plants yielding drugs of abuse – opium, cannabis, coca, tobacco. Identification of plants of *Cannabis sativa* (*Ganja& bhang*) , opium (*Papaversomniferum*), tobacco (*Nicotianatabacum*) etc. in criminal cases.

Unit-16. Forensic Microbiology: Isolation, classification and identification of microbial organism, cell structure of bacteria and fungi, their spores, microbes of soil and spoiled food, microbial organism related to sexual transmitted disease, Collection, Preservation and Forwarding of Samples, Microorganism encountered in biological warfare and its Forensic application.

Unit- 17: Forensic Environmental Biology: Different kind of ecosystems, effects of pollution in aquatic habitat, identification of Algal bloom and their composition, Eutrophication and their effects, Identification methods for coliform bacteria , BOD (biological oxygen demand).

Unit-18. Wild life Forensics: Wild life, Importance of protected and endangered species of Animals and Plants. National and International scenario of wild life, Sanctuaries and National parks. Relevant provision of wild life and environmental act. Types of wildlife crimes, different methods of poaching of wildlife animals, Illegal Trade of wildlife material, Identification and examination of different kinds of wildlife crime exhibits.Examination of fabricated hides, ivory, nail etc.

Unit-19: Forensic Medicine: Death - Signs of death and changes after death. Somatic & Molecular death, Early changes after death - Algor mortis, rigor mortis, cadaveric spasm, heat stiffening, cold stiffening, changes in blood, cadaveric lividity etc. Late changes – putrefaction- external and

internal changes. Adipocere, mummification, gastric and urinary bladder content and time of death from growth of hair and nails. Destruction of body and tissues by bacteria, maggots and other insects, determining time since death from different parameters, Medico legal aspects of death.

Unit-20: Forensic Entomology: Introduction, History, Significance, Classification and Biology of insects and other arthropods, Life cycle and forensic application of insects, determination of time since death (postmortem interval ie PMI) - Dipterans larval development & succession on carrion and its relationship to determine time of death, impact of ecological factors on insects developments, rearing insects & calculating PMI, identification of larval instars, determining whether the body has been moved, linking suspect to the scene, Forensic Entomo-toxicology-identification of drugs and toxins from the insects and larvae feeding on the body, collection and preservation of entomological evidence at a crime scene.

Unit 21: IIuman Genetics: Elements of human genetics- Introduction, Mendel's Law of inheritance, human genetic variations, human chromosomes, chromosomal aberration, Dominant, recessive, co-dominance, incomplete dominance, linkage and crossing over, sex-linked inheritances, polymorphic traits. Heritable human diseases. Metabolic/molecular basis and detection of inherited disease, Mendelian Population, gene pool, Hardy-Weinberg equilibrium law and deviation, genotypes, phenotypes, alleles and multiple alleles, genetic variants, gene structure, genetic code, gene mapping, eukaryotic gene expression, regulation of gene expression, karyotypes, genetic disorders, Genetic markers and their forensic significance. Mutation – Classification, causes, mechanism, role of genetic analysis and evolution. DNA Polymorphism.

Structure of DNA, functions and its properties, Human genome, History of DNA fingerprinting, utility of DNA fingerprinting in crime investigation in parentage dispute, wild life, veterinary and agriculture etc., Legal and Ethical issues. Collection, preservation and transport of samples viz, semen, saliva, hair, bone, flesh etc for DNA profiling, DNA methodology for isolation, typing, interpretation of results, STR analysis, polymerase chain reaction, types and it's application, mitochondrial analysis, determination of sex & species and racial origin.